Iranian Journal of Physics Research, Vol. 22, No. 2, 2022
DOI: 10.47176/ijpr.22.2.51452

# Investigation of electromagnetic plasma waves in the process of formation and growth of plasmoid instability in solar corona in two regimes $\omega_{ce} \asymp \omega_{pe}$

**M Shahrakipour* and M Hosseinpour**

Faculty of Physics, University of Tabriz, Tabriz, Iran

E-mail: mahdishp@tabrizu.ac.ir

(Received 9 May 2022 ; in final form 3 June 2022)

**Abstract**

Using two-dimensional particle-in-cell simulation of collisionless plasmoid instability, the waves generated during formation and growth of plasmoids are investigated. Magnetic reconnection is recognized as a fundamental phenomenon in the conversion of magnetic energy into heating energy and particles acceleration in space and astrophysical plasmas. In this phenomenon stored magnetic energy abruptly released in form of violent plasma jets and non-thermal particles acceleration and relativistic particle acceleration. In large systems such as solar systems that the length of the current layer is much greater than its thickness ,current sheets are affected by complex photospheric motion or external disturbances such as the eruption motion of magnetic structures. This violent plasma instability results in the breakup, fragmentation and formation of multiple current sheets. Therefore reconnection happens at several X points and magnetic islands or plasmids appear. Plasmoid chains are highly dynamic configurations and can fastly grow by coalescence bounce and repel smaller plasmoids. Understanding of the effects of charged particles on the earth's atmosphere depends on a better understanding of the plasmoid instability that we have addressed an aspect of it in this article. The acceleration of charged particles toward the earth's atmosphere is one of the most important consequences of magnetic reconnection and the formation of plasmids in the solar corona as well as in magnetopause and in the magnetotail. The study of electric field components, which are the most important factor of particle acceleration, is very important in recognizing these charged particles. Fourier analysis of electric field components shows different types of electromagnetic and electrostatic waves during the formation and growth of plasmoid instability in both states $\omega_{ce} > \omega_{pe}$ and $\omega_{ce} < \omega_{pe}$ . This analysis reveals that two electromagnetic right and left-hand polarized modes and whistler wave parallel to the initial magnetic field and also the extraordinary mode, ordinary mode and magnetosonic wave perpendicular to the current sheet are excited**.**

**Keywords:** plasma waves, magnetic reconnection, plasmoid instability, solar corona, particle-in-cell simulation.

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